more stable, is supplied in 10 per cent. solution in ampoules containing 5 c.c. The solution is run into the vein very slowly (1 c.c. per minute); meanwhile the patient is engaged in conversation. As the injection proceeds his speech becomes more and more slurred, until finally he fails to answer questions, and sinks into a deep sleep. The administration is stopped immediately he loses consciousness. In this way correct dosage is ensured.

If a small dose of morphine and hyoscine be given beforehand, the intravenous injection is often not remembered at all. Usually very little anaesthetic is needed, although patients vary considerably in this respect; but even after ether, vomiting is practically unknown. Recovery, as a rule, takes place in from two to six hours, followed by the protracted period of drowsiness already mentioned, which may last as long as twenty-four hours.

Illustrative Case

Man aged 56.—Operation: Partial gastrectomy. Heart and lungs, nil abnormal. Blood pressure, 140/80. Fit man of 11 st. 5 lb. 9 a.m., hyoscine compound "A" (hyoscine hydrobrom. gr. $\frac{1}{100}$, morphine sulph. gr. $\frac{1}{6}$, atropine sulph. gr. $\frac{1}{150}$). 9.50 a.m., nembutal 7 c.c. of 5 per cent. solution in sterile distilled water intravenously. Patient went to sleep in midst of a sentence. No excitement. 10 a.m., anaesthetic, nitrous oxide and oxygen with very little ether; good relaxation very easily obtained. Blood pressure, 115/60. 11.25 a.m., returned to bed. Blood pressure, 110/60. Good colour, breathing normally. 2.15 p.m., recovered consciousness. Pulse good. Slept until 4 p.m. without morphine. Final recovery uneventful.

I have no deaths or mishaps to record with the barbiturates. The only case in which they were blamed (I feel sure unjustly) for subsequent events was this:

A girl of 16, apparently healthy, but with a history that she had had several faints and that her fingers often went blue, had an operation for appendicitis. She was given atropine gr. $\frac{1}{100}$, and 5 c.c. of a 5 per cent. solution of nembutal intravenously before operation. No morphine. The anaesthetic was open ether. The operation period was normal and uneventful. While the dressings were being applied, and some minutes after the ether administration had ceased, she quite suddenly stopped breathing and her pulse became impalpable. It was only after the most energetic restorative measures that she started to breathe and her pulse returned. Subsequently she had about forty convulsive fits, probably the result of failure of her cerebral circulation. She did not regain full consciousness for two days, but she finally recovered completely.

I have no idea what caused this patient's collapse—her pulse was good and she behaved in a perfectly normal manner before and during the operation; but I feel sure that, whatever the cause, it cannot be justly attributed to the nembutal she had had.

Conclusions

I must confess a personal preference for either paraldehyde or nembutal. For children I like the former because the barbiturates must generally be given to them by mouth or rectum; and thus administered they so often cause restlessness. For adults nembutal gives equally good results and is less worrying to the patient than paraldehyde. Post-operative restlessness when present is usually slight, and may be controlled by morphine or rectal paraldehyde. I think that both paraldehyde and nembutal are eminently safe in expert hands.

Combinations of drugs act more powerfully, and smaller doses are needed than of any one drug alone. Elimination is easier and quicker than saturation with one. A little morphine, just sufficient nembutal or paraldehyde to produce sleep, and then nitrous oxide and oxygen or ethylene, with a minimum of ether if necessary to produce relaxation, give the patient most protection, least injury, and an easy awakening.

Basal narcosis marks a distinct advance in the administration of anaesthetics. The advantages of minimized mental shock are sufficiently great in themselves to warrant its use; but since, in addition, it enables us to ensure for our patients absence of vomiting and a post-operative period of unconsciousness, during which most of the anaesthetic is eliminated, and a great deal of pain evaded, its use is doubly justified. The public are beginning to recognize its merits, and I feel sure that before long the demand for it will be general.

A certain amount of experience is necessary before one can hope to obtain consistently good results. The administration of an anaesthetic becomes a very different procedure from the older methods we have been accustomed to; and it will be regrettable if reproach is brought upon basal narcosis by the inexpert.

CONGENITAL TALIPES EQUINO-VARUS*

BY

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A case of talipes equino-varus is almost invariably introduced by its mother to the surgeon in the same words: "the baby's feet are twisted in." Too often the only result of long treatment is a change of phrase, much the same appearance coming to be described as "persistent inversion." I propose in this lecture to take the mother's remark as a text, to examine what the "twisting in" actually means, to argue that it is the main element in the deformity, and finally to describe a splint specially designed to combat it.

The Nature of the Deformity

It is, of course, almost impossible to add anything to the many minute descriptions of the anatomy of talipes. My purpose is rather to try to simplify our ideas of it, for if every departure from the normal of every constituent of the foot is separately described, it is beyond the powers

Fig. 1.—Showing how an intrauterine pinioning of the feet could produce the typical talipes deformity.

of most of us to fuse these elements into a coherent mental image. I think the best way in which to do this (though I am far from wishing to reopen the sterile controversy over the causation of the condition) is to say that the deformity is exactly what would result had the plastic feet of the foetus undergone long-continued pressure, while pinioned in a cross-legged position against the concave constricting walls of the uterus. If anyone wishes to see what this purely hypothetical position may be, he should procure a newly born specimen of talipes and suspend it in a landing net. The manner in which the "butt-end" folds up into an ovoid shape and thereby accentuates the deformity is very striking (Fig. 1).

* A lecture delivered to the post-graduate class at the Hospital for Sick Children, Great Ormond Street.

The effect of pressure of this sort is confined to the foot, the tibia being prevented from bending by the support of the opposite limb against which it is folded, and prevented from rotating by the balance of the pressure on the heel against that on the toes. The foot itself is moulded so that its outer surface conforms to the curve of the inner surface of the uterus, which means that it must be curved longitudinally throughout its entire length. This length is divided into a long anterior part (the fore-foot or foot proper) and a short posterior part (the heel) by the fixed point of the ankle-joint. The argument of this lecture is that this longitudinal curve of the fore-part of the foot is the fundamental part of the deformity, that "twisting-in" which is the first thing that strikes the lay observer, and the last thing that defies the surgeon. It is neither the equinus nor the varus of the classic name; they are merely secondary to it, and are its inevitable consequences. No degree of pure equinus nor of varus will produce this longitudinal curve, but it is impossible to bend the fore-foot inwards in this way without swinging the foot as a whole into equino-varus. The proof of this (and of the extremely important converse theorem that bending the foot outwards swings it automatically into calcaneo-valgus) I prefer to leave to a short experiment rather than to a long dissertation on the axes of joints (Fig. 2).

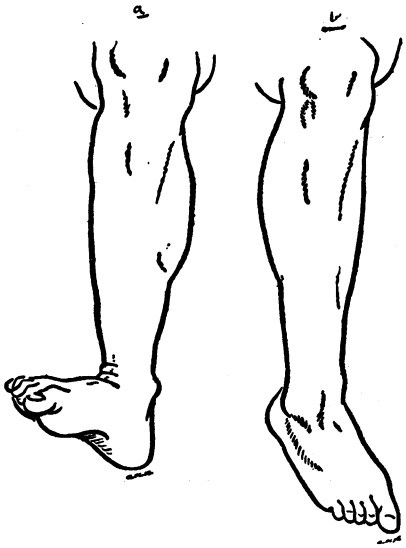

Fig. 2.—*a*, Showing how the foot, when twisted outwards, either actively or passively, to its limit of movement, goes into calcaneo-valgus. *b*, Showing how, on being forced inwards, it goes into equino-varus.

To sum up, the deformity can be resolved into three elements in three planes at right angles to each other: the equinus, best seen from the side; the varus, best seen from the front; and the longitudinal curve of the entire foot, best seen from the rather unfamiliar aspect of Fig. 3, which masks both the other elements. In my opinion this is by far the most instructive view of the condition at any stage. A child lying in this position with free legs shows both the longitudinal curve of the foot itself and the relation of this deformity to the rest of the body. The position usually chosen to illustrate progress, erect on a carefully arranged foot, is only too apt to deceive the surgeon as well as others.

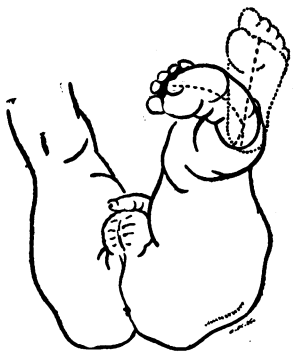

Fig. 3.—View of talipes of left foot to show longitudinal bending. The shape and position of a normal foot are shown in dotted lines.

So far the deformity has only been considered structurally, but functionally also the curve of the fore-foot is of primary importance. Experiment again will prove that if the normal foot is walked upon when turned inwards it goes into a talipes-like position, with a weight-bearing outer border and a contracted and lifted inner one. Conversely, the effect of walking upon the foot when turned outward into the "Chaplin" position is to bring the weight on to its inner border and so stretch and flatten it.

Consequently, whatever measures may be taken to correct the deformity, if they leave the child walking with the fore-foot pointing inwards, a vicious circle is set up. The mal-alignment of the foot increases the deformity, and the deformity increases the mal-alignment of the foot. This action accounts for the familiar rapid relapses of feet which, when suitably posed, appear almost perfect. It must be impressed on all concerned that if the feet are used pointing outwards they will improve, but that if they are used pointing inwards they will get worse.

Principles of Treatment

As I have said, the main object of treatment is the correction of the "twisting in"—in other words, of the longitudinal curve as it affects the fore-part of the foot. If this be fully corrected, the foot will be a satisfactory one; but, on the other hand, if it be allowed to persist, the result will be bad, no matter what else is done. The reason for this is a principle to which I have already referred—that it is impossible to turn the fore-part of the foot outwards without correcting the varus into valgus, and that as this turning out proceeds further the foot as a whole swings into calcaneus. Consequently, by the time the fore-foot is turned fully outwards, the only element of the deformity left is the bending inward of the heel,

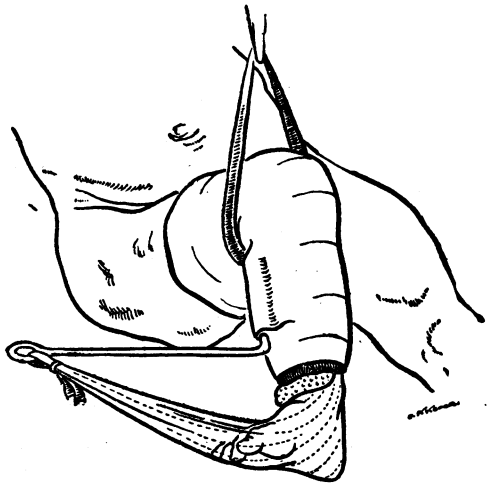

Fig. 4.—The "stocking splint" for correcting talipes.

which, *by itself*, is of negligible effect on appearance and function. It is fortunate that this should be so, as it is extraordinarily difficult to attack the heel directly. The main ways on which we rely for improving its position are, first, by leverage upon it from the fore-foot across the fulcrum of the ankle-joint, and secondly, by means of the free action upon it of the calf muscles, after the varus has been corrected.

I suggest that if the condition be assumed to be due to long-continued gentle moulding, the same sort of force may be the best means of correcting it. I do not think that anyone will deny the possibility of producing a deformity indistinguishable from congenital talipes, displacement of the astragalo-scaphoid joint and all, by pressure of this type applied in the early months of life, provided that it was as constant and ruthless as that which used to be undergone by high-born Chinese girls. A series of cases which I once treated by means of what might be called a "stocking splint" were interesting as to the possibilities of pressure of this kind. The splint (Fig. 4) consisted of a right-angled plaster over the knee,

holding a tube of stockinet round the leg. The lower end of this tube was attached at a slight constant tension to the end of an iron set in the plaster ; both the position of the iron and the pull of the fabric being continually adjusted. I do not recommend this method for general use, but it was possible by means of it to get a surprisingly rapid and complete over-correction of the type shown in Fig. 5.

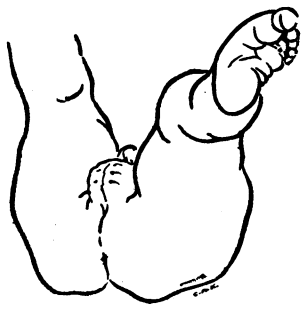

Fig. 5.—Over-correction of talipes obtained by means of the stocking splint.

I am not, of course, maintaining that reduction of the original deformity can be attained without force ; many cases will tax all the strength of our fingers and any skill we may have with the Thomas wrench. But the disadvantages of violence must never be forgotten. Bone has peculiar reactions. If it is forcibly crushed and then left at rest, it tends to build itself up to its original structure and to even greater rigidity than before ; but if it is subjected to continual gentle compression, it melts before it and rebuilds itself in accommodation to the new stresses.

Another disadvantage of wrenching, and to a much greater degree of tenotomies, is that exasperating reaction by which the body, when we have separated two points by dividing the structures between them, fills up the gap with blood, turns this into scar tissue, and leaves it to contract with its familiar force and persistency. The result not seldom is that some time after the operation the bony points separated are in the same relation as before, except that instead of being connected by tissue of normal elasticity, they are indissolubly united by adherent and resentful scar tissue.

Apart from the rigidity thus produced, there is the bad effect of interference with the action of muscles upon their points of insertion. Consider, for instance, the characteristic marked atrophy of the calf muscles and the heel upon which they act. These two structures depend for their development into anything approaching the normal size upon mutual stimulation ; so that to deprive them of this by early division of the tendo Achillis is as disastrous as it is common.

It is not, however, in the attainment of over-correction that failure usually occurs. The trouble comes in maintaining the advantage gained, with, as a penalty for non-success, the repeated recourse to violent methods to restore the lost ground. For the reasons given, the best treatment will use as little violence as possible, striving for a method of restraint that will not only keep the feet in the best position possible, but will tend continuously to correct this position still further. In attempting this it must always be remembered that all the forces to which the foot is exposed, quite apart from the action of the unbalanced muscles and the automatic effect of walking, are hostile. Long clothes, bed-clothes, the position natural to every child of sitting upon the folded feet, all work to turn the toes inwards and downwards. In addition, the natural reaction of the young to any splint is to endeavour to wriggle out of it, and the instinctive way of extricating the foot from any grip is to turn it into equino-varus to minimize the projection of the fore-foot before pulling away. This means that as a general rule, until cure is complete, any time that is not spent either in effective restraint or in using the foot in the correct position is doing harm.

Methods of Treatment

If the main aim of restraining the foot is to maintain an outward bending of the fore-part, and if it be granted that in order to turn it outwards it is necessary to have some purchase from which to work, the various splinting methods can be grouped according to the anchorage they employ.

1. Tin shoes and external malleable splints.—For what it is worth the anchorage in these is their friction against the skin of the leg, but a study of the position of the foot of a vigorous baby some time after they have been applied does not lead to a very high opinion of their efficiency.

2. Sticking-plaster bands, which pull from a grip on the skin of the leg.—These have a better purchase than that of the first group, but this is obviously very weak mechanically, and apt to cause trouble with the skin. Also if the baby is watched in its mother's arms, it will be seen that they do not stop rotation inwards of the foot as a whole beyond the sagittal plane.

3. The use of the femur, held at right angles to the tibia, either by splints or by plaster, for a purchase.—These methods have in different degrees the grave fault of immobilizing the muscles of the leg, and also produce genu valgum by stretching the internal lateral ligament of the knee-joint.

4. The use of the pelvis as a fixed point from which to turn out the feet by means of walking irons.—This has obvious disadvantages, and is very seldom used now.

5. The method, which I believe to be original, of using one foot as a purchase for turning out the other by means of a " hobble splint."

The Hobble Splint

The principle on which this splint depends is, briefly, that if the two feet are fixed in relation to each other, they are also fixed in relation to the median plane of the body in general. Like other statements I have made, this statement is very difficult to prove shortly in the abstract, and yet it needs only the experiment of trying to twist the hips without shifting the position of the feet on the floor to demonstrate its truth. It will be found that " pivoting " is both uncomfortable and extremely limited.

The splint is made as a pair of foot-pieces connected together by the heels, the connexion forming a base from which the fore-parts of the feet can be " twisted out " to any desired angle to the sagittal plane of the body. The foot-pieces are extremely simple, being cut out on the flat in an L shape, with one limb corresponding to the sole of the foot in the position into which it is intended to mould it, and the other bent up at right angles to the heel end of this, so as to fit along the outer side of the leg. The upper end of the leg-piece should be slightly bent outwards to avoid digging into the skin, and will be found far better in this position than in the more usual one at the back of the leg.

These being the foot-pieces, it only remains to arrange them on their base in the correct position, which varies with every case. If there is a normal foot it should of course be inclined at the normal angle of about 20 degrees to the sagittal plane, and the correction to be aimed at in a talipes foot is to get it turned as far beyond this outwards as it was originally set beyond it inwards. In regard to this it may be remarked that one of the arguments in favour of the compression theory of causation is that though in double cases the deformity is always of the same order on both sides, it is never exactly equal ; the presumption being that the foot that is on the outer side in the cross-legged position is the more deformed.

Consequently its side of the splint must be turned out more than the other by 10 degrees or so.

The splint should be cut out of some fairly stiff metal (14 gauge hard aluminium is very suitable), and till the designing of it becomes familiar it is best to make a stiff cardboard model first. The base should first be sketched, the heels being placed with about an inch between their inner borders, and with a broad strip connecting them. Then from the position of the heels each foot-piece is marked out at the correct angle to the base, and finally at right angles to this is drawn the part to be folded up along the legs (Figs. 6 and 7).

To apply the splints, each foot is bandaged in separately by a figure-of-eight bandage of coarse flannel, the meeting of the folds over the instep driving the heel down into position (Fig. 8).

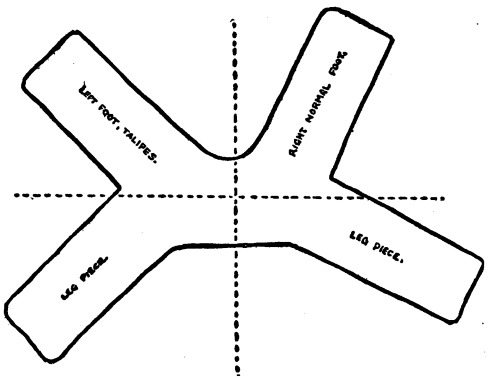

FIG. 6.—Hobble splint for moderate degree of left talipes, marked out on the flat.

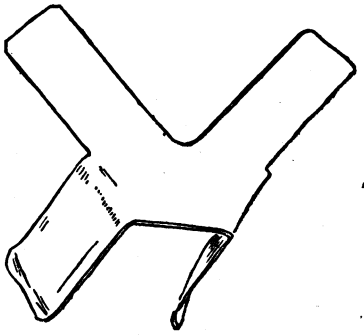

FIG. 7.—Hobble splint for double talipes, completed except for padding.

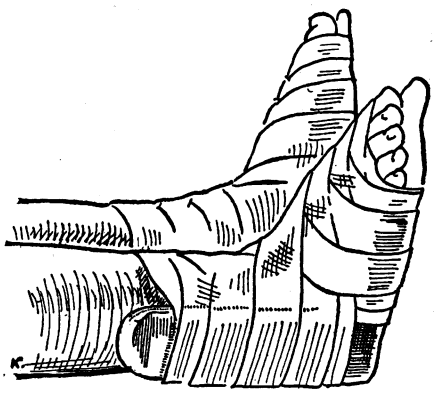

FIG. 8.—Hobble splint applied by figure-of-eight bandages.

I would claim the following advantages for this splint.

1. It is easily made and cheap.

2. One size of it has a very wide range of fitting, so that it does not need to be continually changed as the child grows.

3. The pressure on the foot is applied by soft material over wide areas, and not by hard surfaces to bony points. Consequently there is little tendency to chafing.

4. It is easily applied by an untrained mother once she has mastered the idea of the figure-of-eight bandage, which automatically pulls the foot into position.

5. It is almost impossible to wriggle out of it. It is interesting to see the powerlessness of the child when held in this way. The jiu-jitsu effect of preventing the preliminary inward turn in freeing the foot can only be appreciated by applying a splint of this type to oneself.

6. It really does maintain the outward bending of the foot gained by manipulation, with surprisingly good secondary effects on the equinus and varus.

7. The child can kick freely with the splint in position, so exercising the muscles of the calves and thighs. This is of the utmost importance in developing both these muscles and the bony points to which they are attached, more especially the heel.

In conclusion, I would say that I am fully conscious of the drastic simplifications which I have made of extremely complicated problems. I believe, however, that these simplifications are correct as far as they go. Their disproof lies in the production of cases in which the " twisting in " has been corrected, but in which crippling persists: for their proof I can only ask for a trial of the splint.

I have to thank Dr. C. A. Keogh for that help which only an illustrator who understands the argument can give.

BACTERIAL ENDOCARDITIS IN AN INFANT 13 DAYS OLD

BY

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When Finkelstein[1] suggested in 1905 that the endocardium of the infant was possessed of definite immunity against infection, it is obvious that acute endocarditis in infants was considered to be impossible. Considerably later the opinion was definitely held that, if not non-existent, the condition was certainly very rare. In successive editions of Still's *Common Disorders and Diseases of Childhood* the view is reiterated that " under the age of 3 years it is extremely rare, and under the age of 2 years it is almost unknown." In Ashby and Roberts (1922) it is stated that " endocarditis occurs at all periods of life, it may even attack the foetus: it is met with only rarely under 4." It is stated in Griffith's *Diseases of Infants and Children* (first edition) that " the inflammation may occur in foetal life and thus be one of the causes of congenital cardiac abnormalities. It is uncommon in infancy." Griffith reports that Steffen observed five cases under 1 year, and that Sutiagin reported eleven in the first year, but he considers that such numbers are certainly unusual. Lees and Poynton report one case under 3½ years, and Poynton, in his recent address at the Invalid Children's Aid Association, gave as his impression that about 12 per cent. occur under the age of 5. Bass (Abt's *Pediatrics*, iv, 362) states:

" Acute endocarditis occurs during foetal life, as a rule, on the right side of the heart and in conjunction with developmental defects. Of the post-natal infections, one of the youngest cases is that reported by Czerny in an infant of 1 month suffering from septic endocarditis. Such a case, however, is very exceptional, since endocardial inflammation is rare in children under 2 years of age. In 1,000 post-mortem examinations Holt found no case of acute endocarditis in children under 3 years of age. Steffen (quoted by Lempp), in tabulating forty-five cases of endocarditis in children, found five in children under 1 year; von Dusch, in the same number of cases, reports five in children between the ages of 8 months and 5 years. Lempp reports seven definite cases from Finkelstein's clinic. All of these are in infants, and the mitral valve was shown by autopsy to have been involved in every case. Finkelstein reports fifteen cases of endocarditis in infants, and believes that even at this early age two-thirds of the cases are due to rheumatism, the other third being a manifestation of sepsis. After the second year, and thereafter as the age of the child increases, endocarditis becomes more frequent."

Czerny's case has not been verified.

Later observations tend to show that infantile bacterial endocarditis is not quite so rare as has been considered.